# Competency Task List – Secondary Component

# Electromechanical Technology/Electromechanical Engineering Technology CIP 15.0403

# High School Graduation Years 2023, 2024, 2025

## 100 Technical Reports

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 101 | Complete technical reports. |   |   |
| 102 | Identify the common components of technical documents. |  |  |
| 103 | Maintain a daily journal or timecard. |  |  |

## 200 Safety in the Laboratory

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 201 | Practice accident prevention. |   |   |
| 202 | Practice safe work habits. |   |   |
| 203 | Use hand tools. |   |   |
| 204 | Use portable power tools. |   |   |
| 205 | Use a drill press. |   |   |
|  | RESERVED (206) |   |   |
| 207 | Identify electric shock hazards. |   |   |
|  | RESERVED (208) |   |   |
| 209 | Use fire extinguishers for different classes of fires. |   |   |
| 210 | Collect Safety Data Sheets (SDS) information. |   |   |
| 211 | Follow arc flash protection and National Fire Protection Administration 70E. |   |   |
| 212 | Execute lock out/tag out procedure. |  |  |

## 300 Electrical Symbols on Blueprints and Schematics

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 301 | Interpret electrical symbols, notes, details, and components on schematics. |  |   |
| 302 | Draw schematics for electrical circuits. |  |   |

## 400 Basic Electricity

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
|  | RESERVED (401) |  |   |
| 402 | Describe the application of a magnetic force. |  |   |
| 403 | Describe the atomic structure for materials. |  |  |
| 404 | Describe the direction of electron flow in circuits. |  |  |
| 405 | List the effect of electric current flow. |  |  |
| 406 | Construct simple circuits. |  |  |
| 407 | Define voltage, current, resistance, and power.  |  |  |
|  | RESERVED (408) |  |  |
|  | RESERVED (409) |  |  |
| 410 | Describe the characteristics and purposes of good conductors of electricity. |  |  |
| 411 | Use prefixes in the metric system of measurement. |  |  |
|  | RESERVED (412) |  |  |
| 413 | Follow Ohm's law. |  |  |
| 414 | Follow Watt's law. |  |  |

## 500 Electrical Systems Measurements

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 501 | Use an analog and a digital multimeter to measure voltage, amperage, and resistance. |   |   |
| 502 | Use a non-contact voltage tester to detect voltage. |   |   |
| 503 | Perform a continuity test. |  |  |

## 600 National Electric Code (NEC)

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 601 | Follow regulations for wiring. |   |   |
| 602 | Follow NEC code for sizes and types of wire conductors, raceways, and boxes. |   |   |
| 603 | Follow NEC rules for grounding and bonding. |   |   |
| 604 | Follow NEC rules for over-current protection devices. |  |  |
| 605 | Locate the NEC code for motor circuit wiring. |  |  |
| 606 | Use the NEC reference book to locate regulations for industrial electrical installations. |   |   |

## 700 Electrical Resistance

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 701 | Define resistance. |   |   |
| 702 | Identify resistor materials. |   |   |
| 703 | Describe how length and thickness of wire affect resistance. |   |   |
|  | RESERVED (704) |   |   |
| 705 | Calculate resistance of a wire. |  |  |
|  | RESERVED (706) |  |  |
| 707 | Explain power and heat dissipation in a resistor. |  |  |
|  | RESERVED (708) |  |  |
|  | RESERVED (709) |  |  |
| 710 | Identify components of a potentiometer and rheostat. |  |  |
|  | RESERVED (711-714) |  |  |
| 715 | Identify values for color-coded resistors. |  |  |
|  | RESERVED (716) |  |  |

## 800 Direct Current (DC) Motors

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
|  | RESERVED (801) |   |   |
| 802 | Apply the theory of operation of a direct current motor. |   |   |
| 803 | Operate and test a series, shunt, and compound direct current motor. |   |   |
|  | RESERVED (804) |  |  |
| 805 | Perform calculations for horsepower, speed, and torque for direct current motors. |  |  |
| 806 | Measure performance and efficiency of a direct current motor.  |  |  |
| 807 | Use technical terms to describe the construction of direct current motors. |  |  |
| 808 | Determine the operations of variable speed control for direct current motors. |  |  |

## 900 Inductance and Capacitance

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 901 | Connect a capacitor in a circuit. |   |   |
| 902 | Calculate the time required to charge and discharge a capacitor. |   |   |
| 903 | Identify capacitive and inductive circuits. |   |   |
| 904 | Calculate total capacitance and inductance of series and parallel circuits. |  |  |
| 905 | Perform calculations for capacitive and inductive reactance. |  |  |
| 906 | Analyze the effect of an inductor in a direct current and alternating current circuit. |  |  |
| 907 | Analyze the effect of a capacitor in a direct current and alternating current circuit. |  |  |

##

## 1000 Alternating Current (AC) Motors

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 1001 | Explain the theory of operation of alternating current motors. |   |   |
| 1002 | Calculate the synchronous speed of an alternating current motor. |   |   |
|  | RESERVED (1003) |   |   |
| 1004 | Connect and operate split-phase, capacitor-start, capacitor-run, and dual capacitor motors. |  |  |
| 1005 | Reverse the rotation of a split phase, capacitor-start, capacitor-run, and dual capacitor motors. |  |  |
|  | RESERVED (1006) |  |  |
| 1007 | Determine operating characteristics of universal motors. |  |  |
| 1008 | Connect and operate a three-phase, squirrel cage motor. |  |  |
| 1009 | Reverse the rotation of a three-phase motor. |  |  |

## 1100 Series-Parallel Circuits

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 1101 | Build and test a series circuit. |   |   |
| 1102 | Build and test a parallel circuit. |   |   |
| 1103 | Build and test a series/parallel circuit. |   |   |
| 1104 | Troubleshoot series and parallel circuits. |  |  |
| 1105 | Calculate voltage, current, and resistance. |  |  |
| 1106 | Measure voltage, current, and resistance. |  |  |

## 1200 Electric Motor Controls

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 1201 | Identify symbols and terms used in electromechanical motor control circuits. |   |   |
| 1202 | Identify relays, contactors, and motor starters. |   |   |
| 1203 | Read schematic wiring diagrams of motors and their controls. |   |   |
| 1204 | Wire a simple two- and three-wire motor control circuit. |  |  |
| 1205 | Wire a reversing starter. |  |  |
| 1206 | Wire multiple push button/jogging control circuits. |  |  |
| 1207 | Wire sequential control circuits. |  |  |
| 1208 | Wire and test electrical control circuits. |  |  |
| 1209 | Perform preventive maintenance and troubleshooting on motor controls. |  |  |
|  | RESERVED (1210) |  |  |
|  | RESERVED (1211) |  |  |
| 1212 | Use conductor ampacity to select wire size and wire type for a specific wiring application. |  |  |
| 1213 | Label control and power wiring. |  |  |
|  | RESERVED (1214) |  |  |
| 1215 | Connect and operate alternating current and direct current variable speed drives. |  |  |

## 1300 Transformers

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 1301 | Connect and operate a transformer. |   |   |
| 1302 | Calculate the voltage-and-turns ratio. |   |   |
| 1303 | Connect a step-up and a step-down transformer in a circuit. |   |   |
| 1304 | Identify transformer windings and related output voltages. |  |  |
| 1305 | Calculate volt-amps of a single-phase and three-phase transformer. |  |  |
| 1306 | Measure single-phase transformer voltage and currents. |  |  |
| 1307 | Measure series/parallel transformer voltages and currents. |  |  |
| 1308 | Demonstrate knowledge of three-phase transformers. |  |  |
| 1309 | Wire and analyze three-phase transformers. |  |  |

## 1400 Soldering Techniques

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 1401 | Use and care for soldering equipment. |   |   |
| 1402 | Implement soldering techniques for splicing conductors. |   |   |
| 1403 | Implement soldering techniques for terminals. |   |   |
| 1404 | Remove and install components on a printed circuit board. |  |  |

## 1500 Troubleshoot and Repair Electrical Devices

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 1501 | Troubleshoot and repair motor controls. |   |   |
| 1502 | Troubleshoot and replace relays. |   |   |
| 1503 | Troubleshoot and replace sensors. |   |   |
| 1504 | Troubleshoot and replace limit switches. |  |  |
| 1505 | Troubleshoot and replace power supplies. |  |  |
|  | RESERVED (1506) |  |  |
| 1507 | Troubleshoot alternating current and direct current variable speed drives. |  |  |

## 1600 Basic Electronics

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 1601 | Interpret electronic symbols shown on diagrams and schematics. |   |   |
| 1602 | Identify the function of diodes. |   |   |
| 1603 | Identify the function of Zener diodes. |   |   |
| 1604 | Identify the function of transistors. |  |  |
| 1605 | Identify the function of power supplies. |  |  |
| 1606 | Identify the function of filters. |  |  |
| 1607 | Identify the function of half-wave, full-wave, and three-phase rectifiers. |  |  |
| 1608 | Identify the function of thyristors. |  |  |
| 1609 | Identify the function of single-phase and three-phase inverters. |  |  |
|  | RESERVED (1610) |  |  |
|  | RESERVED (1611) |  |  |

## 1700 Basic Logic Functions

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
|  | RESERVED (1701) |   |   |
| 1702 | Convert between binary, BCD, octal, hexadecimal, and decimal number systems. |   |   |
|  | RESERVED (1703-1705) |   |   |
| 1706 | Construct logic circuits containing and, or, nand, nor, and not gates. |  |  |
| 1707 | Create truth tables for and, or, nand, nor, and not logic. |  |  |
|  | RESERVED (1708) |  |  |

## 1800 Programmable Logic Controls (PLCs)

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 1801 | Explain where programmable logic control (PLC) networks may be used in the manufacturing process. |   |   |
| 1802 | Identify the parts and operating principles of PLCs. |   |   |
| 1803 | Use number systems and codes for PLCs. |   |   |
| 1804 | Create a relay logic diagram. |  |  |
| 1805 | Create PLC logic gate functions in PLCs. |  |  |
| 1806 | Explain PLC logic and math functions. |  |  |
| 1807 | Explain PLC timer and counter functions. |  |  |
| 1808 | Explain PLC jump, compare, and sub-routine functions. |  |  |
| 1809 | Edit PLC programs. |  |  |
| 1810 | Troubleshoot a PLC system. |  |  |

## 1900 Mechanical Power Transmission Systems

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 1901 | Use vocabulary words and terms associated with the fundamental principles of the transmission of mechanical power. |   |   |
| 1902 | Construct simple machines and use them to illustrate mechanical principles. |   |   |
| 1903 | Lubricate bearings. |   |   |
| 1904 | Install and adjust belt, chain, and gear drives. |  |  |
| 1905 | Use brakes and clutches. |  |  |
|  | RESERVED (1906) |  |  |
| 1907 | Set and adjust mechanical stops. |  |  |
| 1908 | Calculate speed and torque rates of mechanical equipment components. |  |  |

## 2000 Troubleshooting and Repair Mechanical Power Transmission Systems

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
|  | RESERVED (2001-2006) |   |   |
| 2007 | Troubleshoot and repair or replace speed-reduction units. |  |  |
| 2008 | Troubleshoot and repair or replace clutches. |  |  |
|  | RESERVED (2009) |  |  |
|  | RESERVED (2010) |  |  |

## 2100 Fluid Power Systems

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 2101 | Interpret electrical and electronic control circuit symbols and schematics for hydraulic systems. |   |   |
|  | RESERVED (2102) |   |   |
| 2103 | Identify fundamentals of hydraulics. |   |   |
| 2104 | Connect and operate various pumps. |  |  |
| 2105 | Identify types of hydraulic fluid transmission and conditioning. |  |  |
| 2106 | Measure oil flow and oil pressure. |  |  |
| 2107 | Operate manual and pilot operated directional control valves. |  |  |
|  | RESERVED (2108) |  |  |
|  | RESERVED (2109) |  |  |
| 2110 | Construct, test and troubleshoot hydraulic control circuits. |  |  |
|  | RESERVED (2111-2120) |  |  |
| 2121 | Perform adjustments to control oil temperature and pressure. |  |  |
| 2122 | Conduct routine preventive maintenance on hydraulic equipment in accordance with manufacturer instructions. |  |  |
| 2123 | Identify electrical symbols/schematics for pneumatics. |  |  |
| 2124 | Apply the fundamental principles of pneumatics. |  |  |
| 2125 | Describe the characteristics of air compressors. |  |  |
| 2126 | Identify systems used for the distribution and conditioning of air. |  |  |
| 2127 | Measure and control air flow and air pressure. |  |  |
| 2128 | Identify pneumatic actuators. |  |  |
| 2129 | Operate and explain mechanical devices that operate on air pressure. |  |  |
| 2130 | Construct, test, and troubleshoot a pneumatic circuit. |  |  |
| 2131 | Analyze pneumatic circuits. |  |  |
| 2132 | Identify where electronic switches and sensors may be found in pneumatic systems. |  |  |
| 2133 | Interpret electric control circuits and devices in pneumatic systems. |  |  |
| 2134 | Sketch flow path symbols and air logic schematics. |  |  |
| 2135 | Interpret flow path symbols and air logic schematics. |  |  |
| 2136 | Select and use properly sized pneumatic piping. |  |  |
| 2137 | Use dampers, thermostats, switches, pneumatic positioners, linkage assembles and accessories in pneumatic systems. |  |  |

## 2200 Troubleshoot and Repair Fluid Power Systems and Their Components

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
|  | RESERVED (2201-2203) |   |   |
| 2204 | Install, troubleshoot, repair or replace, and adjust pressure regulators. |  |  |
| 2205 | Install, troubleshoot, and repair or replace airlines. |  |  |
| 2206 | Install, troubleshoot, repair or replace, and adjust pumps. |  |  |
| 2207 | Install, troubleshoot, and repair or replace gauges. |  |  |
| 2208 | Install, troubleshoot, repair or replace, and adjust cylinders. |  |  |
| 2209 | Install, troubleshoot, and repair or replace filters. |  |  |
| 2210 | Install, troubleshoot, repair or replace and adjust control valves. |  |  |
| 2211 | Install, troubleshoot, and repair or replace actuators. |  |  |
| 2212 | Install, troubleshoot, repair or replace, and adjust pressure switches. |  |  |
| 2213 | Install, troubleshoot, repair or replace, and adjust relays. |  |  |
|  | RESERVED (2214) |  |  |
|  | RESERVED (2215) |  |  |
| 2216 | Conduct routine preventive maintenance on pneumatic equipment in accordance with manufacturer instructions. |  |  |
| 2217 | Install, troubleshoot, and repair or replace, hydraulic lines.  |  |  |
| 2218 | Install, troubleshoot, repair or replace, and adjust hydraulic pumps. |  |  |
| 2219 | Install, troubleshoot, and repair or replace hydraulic gauges.  |  |  |
| 2220 | Install, troubleshoot, and repair or replace hydraulic filters.  |  |  |
| 2221 | Install, troubleshoot, and repair or replace hydraulic directional control valves.  |  |  |
| 2222 | Install, troubleshoot, repair or replace, and adjust hydraulic pressure control valves.  |  |  |

## 2300 Robotics

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 2301 | Follow safety rules and regulations for working around robots. |   |   |
| 2302 | Use vocabulary words and terms specific to robotics. |   |   |
| 2303 | Identify major systems of a robot. |   |   |
| 2304 | Identify a robot’s work envelope in a manufacturing cell. |  |  |
|  | RESERVED (2305) |  |  |
| 2306 | Determine the operation of a robot's drive system. |  |  |
| 2307 | Determine the mobility of an industrial robot. |  |  |
| 2308 | Program a robot. |  |  |
| 2309 | Use a robot for industrial applications. |  |  |

## 2400 Works Cells in a Manufacturing System

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 2401 | Identify the fundamental operating principles used in flexible manufacturing systems. |   |   |
|  | RESERVED (2402) |   |   |

## 2500 Raceway Systems

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| --- | --- | --- | --- |
| Item | Task  | (X) Indicates Proficiency 1 | Secondary Course Crosswalk |
| 2501 | Cut, bend, and install conduit or tubing.  |   |   |
| 2502 | Install raceway or wire duct. |   |   |

1 Student Demonstrated Entry-Level Industry Proficiency as Indicated by (X)

Secondary CTE Instructor Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student Signature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[PA In-Demand Occupations List (PA IDOL)](https://nam10.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.workstats.dli.pa.gov%2FProducts%2FIDOL%2FPages%2Fdefault.aspx&data=04%7C01%7Celw12%40psu.edu%7C465d2f58a43f45631dac08d9e0349a4c%7C7cf48d453ddb4389a9c1c115526eb52e%7C0%7C0%7C637787338795980555%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000&sdata=yZW%2BaPOFwIBGxV3Jk72%2BGXlAbGWgkjCVKy%2FQtYol1F0%3D&reserved=0)

[Industry-Recognized Credential Resource Guide](https://www.education.pa.gov/K-12/Career%20and%20Technical%20Education/Resources/Teacher%20Resources/IndustryRecognized/Pages/default.aspx)